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Do Differences in Childhood Diet Explain the Reduced Overweight Risk in Breastfed Children?

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Breastfeeding has been associated with a reduced risk of overweight later in life. This study investigates whether differences in diet and lifestyle at 7 years of age between breastfed and formula-fed children can explain the difference in overweight prevalence at 8 years of age. We studied 2,043 Dutch children born in 1996–1997 who participated in the Prevention and Incidence of Asthma and Mite Allergy birth cohort study. Data on breastfeeding duration and diet and lifestyle factors at 7 years were collected using questionnaires. Weight and height were measured at 8 years. Overweight was defined according to international gender- and age-specific standards. Compared to nonbreastfed children (15.5%, *n* = 316), children breastfed for >16 weeks (38.0%, *n* = 776) consumed fruit and vegetables significantly more often and meat, white bread, carbonated soft drinks, chocolate bars, and fried snacks less often. Overall, breastfed children were less likely to have an unhealthy diet (adjusted prevalence ratio: 0.77, 95% confidence interval: 0.61–0.98). The associations could only partly be explained by maternal education, maternal overweight, and smoking during pregnancy. At 8 years, 14.5% (*n* = 297) of the children were overweight. Breastfeeding for >16 weeks was significantly associated with a lower overweight risk at 8 years (adjusted odds ratio: 0.67, 95% confidence interval: 0.47–0.97), and the association hardly changed after adjustment for diet (adjusted odds ratio: 0.71, 95% confidence interval: 0.49–1.03). Breastfed children had a healthier diet at 7 years compared to nonbreastfed children, but this difference could not explain the lower overweight risk at 8 years in breastfed children.

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INTRODUCTION

Breastfeeding has been associated with a reduced risk of overweight in childhood and adulthood (1,2). An important question is, whether this association is due to a healthier diet and lifestyle of breastfed children compared to nonbreastfed children.

Breastfeeding initiation and continuation depends on the choice of the mother and is associated with various maternal characteristics (3–6). Studies in the Netherlands and the United Kingdom showed that the main reason for mothers to breastfeed their child was because they believed breastfeeding was healthier than formula feeding (3,4). Mothers who choose to breastfeed may, therefore, also differ in other health-related behavior from mothers who choose to formula feed and hence influence their children's diet and lifestyle.

Taveras *et al.* showed that mothers who breastfed were less restrictive in respect to their children's food intake at 1 year of age, and both breastfeeding and the less restrictive behavior were associated with a lower BMI at 3 years of age (6,7). However, the association between breastfeeding and BMI was only minimally attenuated by the less restrictive behavior.

The aim of this study was to assess the association between breastfeeding and children's diet and lifestyle at 7 years of age, and to investigate to what extent differences in diet and lifestyle factors between breastfed and nonbreastfed children could explain the association between breastfeeding and overweight at 8 years of age.

METHODS AND PROCEDURES

Study design and study population

For this study, we used data from 2,043 Dutch children who were born in 1996–1997 and participated in the Prevention and Incidence of Asthma and Mite Allergy birth cohort study. A detailed description of the study design has previously been published (8). At baseline,

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the study population consisted of 4,146 mothers who were recruited from the general population during pregnancy. At 8 years of age, 3,668 children (88% of 4,146) were still participating in the Prevention and Incidence of Asthma and Mite Allergy study; 3,518 children were invited for the medical examination; and 2,214 children participated in the medical examination and were weighed and measured. The main reason for not inviting children was that they had moved and were now living too far away from the study centers. After exclusion of twins and children born prematurely (n = 116), children with missing data on breastfeeding (n = 16), on all dietary data at 7 years of age (n = 32) or on maternal education (n = 7), 2,043 children were available for analyses.

Data on breastfeeding, diet, lifestyle, and confounding factors were collected by means of postal questionnaires, which were sent to the parents during pregnancy, 3 months after the child was born, and from age 1 year annually. The study protocol was approved by the medical ethics committees of the participating institutes, and all parents gave written informed consent.

Breastfeeding and confounder assessment

Duration of breastfeeding was assessed by questions on infant feeding in the questionnaires administered at 3 months and at 1 year of age. At 3 months, we asked the parents how long the child was breastfed and whether the mother was still breastfeeding. If the parents indicated in the questionnaire at 3 months that the mother was still breastfeeding, we used data from the 1-year questionnaire to assess the total breastfeeding duration. The answers on these questions were combined to one variable and categorized as "no breastfeeding," "1–16 breastfeeding," and ">16 weeks breastfeeding." The cutoff point of 16 weeks was chosen, because until recently, the recommended breastfeeding duration in the Netherlands was 4–6 months, and only a small percentage of the mothers breastfed for at least 6 months. Breastfeeding was defined as any kind of breastfeeding, including partial breastfeeding.

Maternal educational level was measured as the highest education completed and then divided into three categories (low, intermediate, and high education). Employment of the mother when the child was 1 year of age was classified as employed or unemployed. Maternal BMI (kg/m^2) was calculated from self-reported body weight (kg) and height (m) when the child was 1 year of age, and overweight was defined as BMI ≥25 kg/m^2. Maternal smoking during pregnancy was defined as any smoking by the mother during pregnancy after the fourth week of pregnancy.

Dietary and lifestyle assessment

The questionnaire at 7 years of age contained a food-frequency questionnaire. The parents were asked to report how often in the previous month their child consumed a certain food or drink. Response options were: "not at all," "less than once a week," "at 1 or 2 days per week," "at 3–5 days per week," and "at 6 or 7 days per week." In the analysis of the consumption frequency of individual food items, daily (6–7 times per week) consumption was compared to nondaily (less than 6 times per week). If the food item was only consumed daily by a small number of children (<10%), the three highest consumption frequency categories were taken together to make a classification in weekly (1–7 times per week) and nonweekly (less then once per week).

To create a variable that indicated whether the child had a low fruit and vegetable consumption the response on the variables "daily fruit consumption," "daily cooked vegetable consumption," and "weekly uncooked vegetable consumption" were combined. Children who scored negative on two out of three variables were regarded as having a low fruit and vegetable consumption. To create a variable that indicated whether the child consumed unhealthy foods (i.e., snacks) frequently the responses on the variables weekly consumption of "carbonated soft drinks," "chocolate bars," "fried snacks or chips," and "crisps or salty snacks" were combined. Children who scored positive on two out of four variables were regarded as having high snack consumption. Children who had a low fruit and vegetable consumption in combination with a high snack consumption were considered to have a less favorable (unhealthy) diet at 7 years of age.

Parents also reported if the child consumed any organically grown or bred products. Furthermore, the questionnaire contained questions regarding the number of hours a day the child watched television, watched videos or played computer games, and the number of hours the child played actively. The four response options that were available, ranging from less than half an hour a day till >2 h a day, were classified as <1 h per day and >1 h per day. Watching television, watching videos, or playing computer games were categorized as "television watching."

Overweight assessment

During the medical examination at 8 years, children were weighed and measured in their underwear. Weight was measured to 0.1 kg and height to 0.1 cm by trained research staff using calibrated measuring equipment. From the weight and height measurements, BMI (weight (kg)/height (m)^2) was calculated. Overweight was defined according to age and gender specific international standards that use cutoff points equivalent to the 25 kg/m^2 cutoff that is commonly used for adults (9). We use the term "overweight" for the total group of children who are either moderately overweight or obese.

Statistical analysis

Although some children had missing data on some of the dietary or lifestyle variables, the number of missing values per variable did not exceed 1% of the total study population. To account for missing data on the confounding factors, that is, maternal smoking during pregnancy and maternal overweight, these variables contained a category for observations with missing data. Log linear regression analysis was used to analyze the association between the exposure variable breastfeeding and the outcome variables diet and lifestyle. Logistic regression analysis was less feasible because the probability of the outcome was relatively high. A logistic regression would overestimate the relative risk and produce invalid confidence limits in that case (10,11). We used the PROC GENMOD procedure in SAS software version 9.1 (SAS Institute, Cary, NC) to calculate the prevalence ratio and 95% confidence interval (11). All dietary or lifestyle variables were included separately in the regression models. Maternal education, maternal overweight, maternal smoking during pregnancy, maternal age, and maternal employment were considered as potential confounders. Interactions between breastfeeding and maternal education were tested.

To analyze the association between the exposure variable breastfeeding and the outcome variable overweight at 8 years of age, logistic regression was used. The association between breastfeeding and overweight at 8 years of age was additionally adjusted for the dietary factors that were significantly associated with breastfeeding. If both a combination variable (low fruit and vegetable consumption) and the individual variable (daily fruit consumption) were significantly associated with breastfeeding, the combination variable was included in the model. P values below 0.05 were considered to be statistically significant.

RESULTS

More than 84.5% (n = 1,727) of the mothers breastfed, and 38.0% of the mothers (n = 776) breastfed their child for >16 weeks (**Table 1**). Mothers who breastfed for >16 weeks were more often highly educated and were less likely to be overweight and to smoke during pregnancy than mothers who did not breastfeed or who breastfed for <16 weeks (**Table 1**).

Comparison of the children included in the analyses with the excluded children showed that mothers of children included in the analyses were more often highly educated and were more likely to breastfeed.

At 7 years of age, children breastfed for >16 weeks consumed brown bread, fruit, cooked vegetables, and uncooked vegetables statistically significantly more often and sugar-sweetened

Table 1 Prevalences and means (s.d.) of various maternal and children's characteristics by breastfeeding duration (*n* = 2,043)

			Breastfeeding duration					
	All		0 weeks		1–16 weeks		>16 weeks	
Variables	%	(*n*)	%	(*n*)	%	(*n*)	%	(*n*)
n		2,043	15.5	(316)	46.6	(951)	38.0	(776)
Gender (% girls)	50.0	(1,021)	45.9	(145)	49.5	(471)	52.2	(405)
Maternal overweight	25.8	(495)	30.6	(90)	28.6	(252)	20.6	(153)
Maternal smoking during pregnancy	16.1	(326)	21.8	(68)	18.3	(172)	11.2	(86)
Maternal employment	67.3	(1,356)	61.9	(192)	73.5	(686)	62.1	(478)
Maternal education								
Low	19.8	(405)	34.5	(109)	21.2	(202)	12.1	(94)
Intermediate	42.4	(866)	46.5	(147)	43.9	(417)	38.9	(302)
High	37.8	(772)	19.0	(60)	34.9	(332)	49.0	(380)
Overweight child at 8 years	14.5	(297)	20.9	(66)	14.1	(134)	12.5	(97)
	Mean	(s.d.)	Mean	(s.d.)	Mean	(s.d.)	Mean	(s.d.)
Age child at diet assessment (years)	7.1	(0.1)	7.1	(0.1)	7.1	(0.1)	7.1	(0.1)
Maternal age (years)	30.7	(3.8)	30.3	(3.8)	30.5	(3.9)	31.3	(3.6)

Table 2 Prevalence of children's consumption frequencies of various food items at 7 years of age by breastfeeding duration (*n* = 2,043)

	Breastfeeding duration					
	0 weeks (*n* = 316)		1–16 weeks (*n* = 951)		>16 weeks (*n* = 776)	
Variables	%	(*n*)	%	(*n*)	%	(*n*)
Daily consumption[a]						
Skimmed or low-fat milk	54.9	(173)	55.4	(527)	58.7	(455)
Sugar-sweetened milk products	41.5	(131)	33.8	(321)	30.4	(236)
Meat	57.0	(180)	51.6	(491)	47.4	(368)
Brown bread	74.1	(234)	80.6	(766)	84.9	(659)
Fresh fruit	49.7	(157)	56.3	(535)	61.9	(480)
Cooked vegetables	30.7	(97)	33.9	(322)	43.6	(338)
Fruit juice	24.7	(78)	23.0	(219)	26.7	(207)
Lemonade	51.0	(161)	48.5	(461)	49.2	(382)
Cookie or biscuit	39.2	(124)	37.2	(354)	39.6	(307)
Candy or chocolate	60.4	(191)	58.5	(556)	59.0	(458)
Weekly consumption[a]						
Full-fat milk	9.5	(30)	8.1	(77)	11.1	(86)
Fish	34.5	(109)	36.5	(347)	40.5	(314)
White bread	41.5	(131)	30.0	(285)	26.9	(209)
Pulses[b]	38.6	(122)	38.1	(362)	41.5	(321)
Uncooked vegetables	51.3	(162)	56.6	(538)	62.5	(485)
Carbonated soft drinks	35.4	(112)	28.1	(267)	25.5	(198)
Chocolate bars	25.6	(81)	19.7	(187)	15.2	(118)
Fried snacks or chips	30.1	(95)	26.9	(256)	19.1	(148)
Crisps or salty snacks	63.0	(199)	57.9	(551)	54.5	(423)
Dietary characteristics						
Low fruit/ vegetable consumption	55.4	(175)	50.0	(475)	38.3	(297)
High snack consumption	48.1	(152)	41.2	(392)	34.0	(264)
Unhealthy diet	29.8	(94)	22.8	(217)	17.0	(132)
Consumption of organic products	12.3	(39)	20.7	(197)	33.8	(262)
Physical activity child (>1 h per day vs. <1 h per day)						
Television watching	49.9	(154)	42.7	(402)	36.8	(283)
Active playing	54.3	(171)	56.0	(526)	53.4	(410)

[a]Daily consumption: 6–7 times per week vs. less than 6 times per week; weekly consumption: 1–7 times per week vs. less than once per week. [b]Pulses include beans, peas, and lentils.

milk products, meat, white bread, carbonated soft drinks, chocolate bars, fried snacks, and crisps less often than non-breastfed children (Tables 2 and 3). Breastfed children were less likely the have a low fruit and vegetable consumption, a high snack consumption, or an unhealthy diet. The associations attenuated after adjustment for maternal education, maternal smoking during pregnancy, and maternal overweight, but remained significant, except for the association with uncooked vegetables and fruit. Breastfed children were significantly more likely to consume organic products and were less likely to watch >1 h of television per day than children who were not breastfed.

In most cases, maternal education accounted for the greatest proportion of attenuation in effect estimates of the association between breastfeeding and consumption frequencies of the food items. Additional adjustment for maternal age and maternal employment did not affect the associations. The interaction between breastfeeding and maternal education was not statistically significant. Stratification by maternal education demonstrated that the associations between breastfeeding and dietary and lifestyle factors were apparent in all three education categories (Figures 1 and 2). Figures 1 and 2 show that the percentage of children with an unhealthy diet and the percentage of children that watched television for >1 h per day decreased with increasing maternal education level and with increasing breastfeeding duration.

Table 3 Associations between breastfeeding duration and children's consumption frequencies of various food items at 7 years of age (no breastfeeding is reference, *n* = 2,043)

	Breastfeeding duration			
	1–16 weeks (*n* = 951)		>16 weeks (*n* = 776)	
Variable	Crude PR (95% CI)[b]	Adjusted[a] PR (95% CI)[b]	Crude PR (95% CI)[b]	Adjusted[a] PR (95% CI)[b]
Daily consumption[c]				
Skimmed or low-fat milk	1.01 (0.90; 1.13)	0.98 (0.87; 1.09)	1.07 (0.95; 1.20)	0.98 (0.88; 1.11)
Sugar-sweetened milk products	0.81 (0.69; 0.95)*	0.83 (0.71; 0.98)*	0.73 (0.62; 0.87)**	0.76 (0.64; 0.91)*
Meat	0.91 (0.81; 1.02)	0.92 (0.82; 1.04)	0.83 (0.74; 0.94)*	0.87 (0.76; 0.98)*
Brown bread	1.09 (1.01; 1.17)*	1.07 (1.00; 1.14)	1.15 (1.07; 1.23)**	1.08 (1.01; 1.16)*
Fresh fruit	1.13 (1.00; 1.28)*	1.07 (0.95; 1.21)	1.24 (1.10; 1.41)*	1.12 (1.00; 1.27)
Cooked vegetables	1.10 (0.91; 1.33)	1.05 (0.87; 1.27)	1.42 (1.18; 1.71)**	1.31 (1.09; 1.58)*
Fruit juice	0.93 (0.75; 1.17)	0.91 (0.72; 1.14)	1.08 (0.86; 1.36)	1.04 (0.83; 1.31)
Lemonade	0.95 (0.84; 1.08)	0.96 (0.85; 1.09)	0.97 (0.85; 1.10)	0.99 (0.86; 1.13)
Cookie or biscuit	0.95 (0.81; 1.11)	0.92 (0.78; 1.08)	1.01 (0.86; 1.19)	0.95 (0.80; 1.13)
Candy or chocolate	0.97 (0.87; 1.07)	0.96 (0.87; 1.07)	0.98 (0.88; 1.09)	0.96 (0.86; 1.07)
Weekly consumption[c]				
Full-fat milk	0.85 (0.57; 1.28)	0.88 (0.59; 1.32)	1.17 (0.79; 1.73)	1.27 (0.84; 1.90)
Fish	1.06 (0.89; 1.26)	1.01 (0.85; 1.20)	1.17 (0.99; 1.40)	1.09 (0.91; 1.30)
White bread	0.72 (0.61; 0.85)**	0.78 (0.67; 0.92)*	0.65 (0.55; 0.77)**	0.74 (0.62; 0.89)**
Pulses	0.99 (0.84; 1.16)	0.97 (0.83; 1.14)	1.07 (0.91; 1.26)	1.04 (0.88; 1.23)
Uncooked vegetables	1.10 (0.98; 1.25)	1.02 (0.91; 1.15)	1.22 (1.08; 1.38)*	1.09 (0.96; 1.23)
Carbonated soft drinks	0.79 (0.66; 0.95)*	0.83 (0.70; 1.00)*	0.72 (0.59; 0.87)*	0.81 (0.67; 0.99)*
Chocolate bars	0.77 (0.61; 0.96)*	0.83 (0.66; 1.05)	0.59 (0.46; 0.76)**	0.70 (0.54; 0.90)*
Fried snacks or chips	0.90 (0.73; 1.09)	0.99 (0.82; 1.21)	0.63 (0.51; 0.79)**	0.79 (0.63; 0.99)*
Crisps or salty snacks	0.92 (0.83; 1.02)	0.93 (0.84; 1.03)	0.87 (0.78; 0.96)*	0.89 (0.79; 0.99)*
Dietary characteristics				
Low fruit/vegetable consumption	0.90 (0.80; 1.01)	0.93 (0.81; 1.06)	0.69 (0.60; 0.79)**	0.83 (0.73; 0.95)*
High snack consumption	0.86 (0.75; 0.98)*	0.98 (0.88; 1.10)	0.71 (0.61; 0.82)**	0.83 (0.71; 0.96)*
Unhealthy diet	0.77 (0.62; 0.94)*	0.89 (0.73; 1.09)	0.57 (0.45; 0.72)**	0.77 (0.61; 0.98)*
Consumption of organic products	1.68 (1.22; 2.31)*	1.39 (1.02; 1.91)*	2.74 (2.01; 3.73)**	1.99 (1.46; 2.70)**
Physical activity child (>1 h per day vs. <1 h per day)				
Television watching	0.87 (0.76; 1.00)*	0.91 (0.80; 1.04)	0.75 (0.65; 0.87)**	0.82 (0.71; 0.96)*
Active playing	1.03 (0.92; 1.16)	1.04 (0.93; 1.17)	0.98 (0.87; 1.11)	1.00 (0.88; 1.14)

[a]Adjusted for maternal education, maternal overweight, and maternal smoking during pregnancy. [b]PR (95% CI): prevalence ratio and 95% confidence interval. [c]Daily consumption: 6–7 times per week vs. less than 6 times per week; weekly consumption: 1–7 times per week vs. less than once per week. *$P < 0.05$; **$P < 0.001$.

At 8 years of age, 14.5% (n = 297) of the children were overweight. Children breastfed for 1–16 weeks and children breastfed for >16 weeks were significantly less likely to be overweight compared to nonbreastfed children (Table 4). Additional adjustment for factors that were significantly associated with breastfeeding (i.e., daily consumption of brown bread, meat and sugar-sweetened milk products, and weekly consumption of white bread, a low fruit and vegetable consumption, a high snack consumption, consumption of organic products, and television watching at 7 years) hardly changed the association between breastfeeding and overweight.

DISCUSSION

Breastfeeding was associated with a variety of diet and lifestyle factors at 7 years of age, which could only partially be explained by maternal characteristics. These differences in diet and lifestyle between breastfed and nonbreastfed children did not explain the lower overweight prevalence in breastfed children at 8 years of age.

Strengths and limitation

Strengths of this study are the prospective study design, the large study population, and the availability of measured data on weight and height. Also, we were able to study a large variety

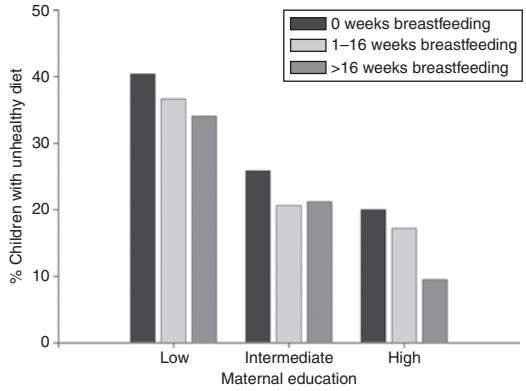

Figure 1 Percentage of 7-year-old children with an unhealthy diet (low fruit and vegetable consumption in combination with a high snack consumption) by breastfeeding duration and maternal education.

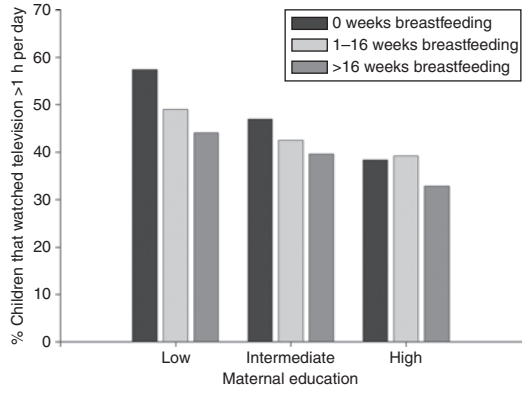

Figure 2 Percentage of 7-year-old children who watched television for >1 h per day by breastfeeding duration and maternal education.

of dietary variables. Because breastfeeding duration, diet, and lifestyle were reported prospectively, the probability of recall bias was eliminated.

A limitation of the study is that the food-frequency questionnaire contained a limited number of foods and drinks. However, most foods and drinks associated with childhood overweight were included in the questionnaire. Also, no information was available on portion sizes, which made it not possible to obtain detailed information on the child's food, nutrient, and energy intake. The assessment of the number of hours that the child watched television and played actively was limited and did not include a wide range of different forms of physical activity. Watching television is an important form of inactivity at that age and probably is an indicator of an inactive lifestyle.

Information bias is a concern because data on diet and lifestyle of the child were reported by the parents. Mothers who breastfed their child might have been more health conscious and might have had more knowledge on healthy dietary behavior. This could have influenced their responses and thus result in an overestimation of the consumption frequency of healthy foods and an underestimation of unhealthy foods in breastfed children. As the questionnaire's main focus was on asthma and allergy and not on diet and lifestyle, it is less likely that parents were tempted to give desirable answers on the questions on diet and lifestyle of the child.

Table 4 Adjusted associations between breastfeeding and overweight at 8 years of age (no breastfeeding is reference, *n* = 2,043)

	Breastfeeding duration		
	0 weeks (*n* = 316)	1–16 weeks (*n* = 951)	>16 weeks (*n* = 776)
		OR (95% CI)	OR (95% CI)
Crude association	—	0.62 (0.45; 0.86)*	0.54 (0.38; 0.76)**
Adjusted association[a]	—	0.66 (0.47; 0.92)*	0.67 (0.47; 0.97)*
Association additionally adjusted for diet and television watching at 7 years[b]	—	0.67 (0.48; 0.95)*	0.71 (0.49; 1.03)

CI, confidence interval; OR, odds ratio.
[a]Adjusted for maternal education, maternal overweight, and maternal smoking during pregnancy. [b]Additionally adjusted for daily consumption of brown bread, meat and sugar-sweetened milk products, and weekly consumption of white bread, a low fruit and vegetable consumption, a high snacks consumption, consumption of organic products, and television watching at 7 years of age. *$P < 0.05$; **$P < 0.001$.

The children included in the study had more often mothers who had a high educational level than the children excluded from the analyses. However, the reported associations probably can be generalized to the total study population, because no effect modification by maternal educational level was observed in the associations.

Findings of other studies

Three studies have previously been published on the association between breastfeeding and diet of children (12–14). Lande *et al.* (13) reported similar associations between breastfeeding and the consumption of meat and sugar-sweetened drinks in Norway. However, their study population consisted of 1-year-old children and some children still received breast milk. Cooke *et al.* (12) focused on fruit and vegetable consumption among 2–6-year-old children in London. They reported a higher consumption frequency of fruit and vegetables among breastfed children, which is in accordance with our results. Toschke *et al.* (14) studied physical activity, television watching, and fruit consumption among Czech schoolchildren who were either breastfed or formula fed. They observed that breastfed children were less likely to watch television and consumed fruit more often, but these differences could not explain differences in overweight prevalence in children of 6–14 years. Victora *et al.* (15) did not observe an association between breastfeeding and type of diet and physical activity in 18-year-old men and saw no effect of these variables on the association between breastfeeding and obesity at 18 years of age. One study reported a considerable attenuation of the significant association between breastfeeding and obesity at 7 years after adjustment for confounding factors, including the dietary pattern at 7 years of age (16).

Interpretation of the results

The observed association between breastfeeding and diet might be explained by psychosocial as well as biological factors. As

Kramer *et al*. (17) put it in their paper, mothers who breastfeed may be more "health conscious" or more "nutrition conscious" and offer their child healthy foods more frequently. This "health consciousness" can probably not fully be explained by differences in maternal education, maternal overweight, and maternal smoking during pregnancy. A biological explanation for the findings of this study could be that breastfed children, in contrast to children who were formula fed, are exposed to flavors from the maternal diet that are transmitted to the milk. Therefore, breastfed children are used to a variety of flavors (18) and are more likely to accept new foods in early life, in particular fruits and vegetables (19,20). However, the difference we observed in this study between breastfed and nonbreastfed children in the number of hours the child watched television cannot be explained by biologic factors. This observation points again in the direction of different lifestyle choices between parents.

Breastfeeding for >16 weeks was associated with a lower overweight risk compared to nonbreastfeeding. In spite of the large differences in diet and lifestyle factors between breastfed and nonbreastfed children, as observed in this study, these differences did not explain the lower overweight risk in breastfed children. This finding suggests that the association between breastfeeding and overweight could not be attributed to the difference in diet between breastfed and nonbreastfed children, although a study with detailed data on nutrient and energy intake is needed to confirm our results.

The lower overweight prevalence at 8 years of age among breastfed children might be a consequence of a lower weight gain during infancy. In our previously published paper we observed that breastfed children had a lower weight gain during the first year of life and a lower BMI at 7 years of age (21). The lower weight gain of breastfed children in the first year of life might be caused by a lower milk intake compared to nonbreastfed children (22).

The follow-up till 8 years of age could have been too short to observe attenuation by recent dietary habits on the association between breastfeeding and overweight. For disease outcomes in adulthood that are associated with breastfeeding, such as overweight (1,2) and cardiovascular diseases (23–25), confounding by dietary and lifestyle factors might be more important due to prolonged exposure.

The results of this study show that breastfed children had a healthier diet and lifestyle at 7 years of age than nonbreastfed children, independent of maternal characteristics, but these differences could not explain the lower overweight prevalence at 8 years of age in breastfed children compared to nonbreastfed children.

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DISCLOSURE

The authors declared no conflict of interest.

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